STATE OF CALIFORNIA
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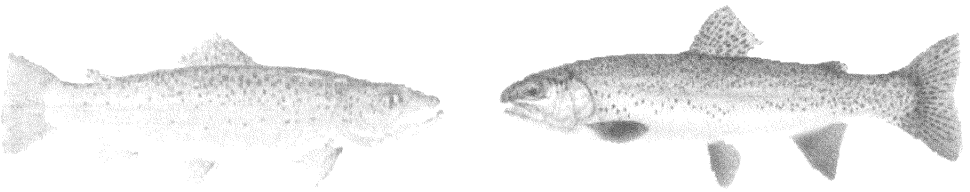
STANDING STOCKS OF TROUT IN SECTIONS OF INDIAN CREEK, PLUMAS COUNTY, 1999



Central Valley Bay-Delta Branch

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by

Charles J. Brown
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INTRODUCTION

In 1976, the Department of Water Resources (DWR) initiated an instream flow study to identify streams that would benefit from flow enhancement to assess instream values required to enhance these streams. The Northern District of DWR selected Indian Creek below Antelope Reservoir (Figure 1) as one of the streams to study under this program. Initial flow studies by DWR indicated that flow augmentation could double trout habitat in the first 16 km of Indian Creek below the dam and increase habitat by 25 percent in lower reaches (DWR 1979). As a result of this study, DWR and the Department of Fish and Game (DFG) reoperated Antelope Reservoir beginning in March 1978 to increase flow releases from 0.1 cms to 0.6 cms year-round during normal and wet years to enhance recreation and fishery values (Hinton 1983). Brown (1993) reported that increased flows had increased trout standing stocks and numbers of catchable trout.

Sampling of salmonids was begun in Indian Creek at six different stations in 1977. Sampling continued through 1982 on a yearly basis to provide baseline data for salmonid biomass (Brown 1978, Brown and Haines 1979, Haines and Brown 1980, Villa and Brown 1981, Villa 1982, Bumpass et. al. 1987a). Fish were not sampled in 1983, 1984, or 1985. Sampling resumed in 1986 and continued in 1987, 1988, 1989, 1990, and 1995 (Bumpass et. al. 1987b, Bumpass and Smith 1989, Bumpass and Brown 1989, Brown 1991a, Brown 1991b, Brown 1993, and Brown 1996).

The objective of this study is to estimate the number, age, and growth of trout in previously established stations. The stations were originally established to set baseline conditions with which future changes in seasonal stream flow or other elements of habitat would be compared. A report summarizing fisheries studies on Indian Creek was published in 1993 (Brown 1993).

STUDY AREA

The Indian Creek study area extends from the stream at the base of Antelope Dam to Flournoy Bridge (Figure 1). The stream flows through rocky canyons and grassy meadows. Elevation in the study area averages 1464 m. Steep hillsides surrounding the stream are covered with pine, cedar, and fir trees. Trees that border the stream are predominantly alder. Indian Creek averages 7m in width in the study area.

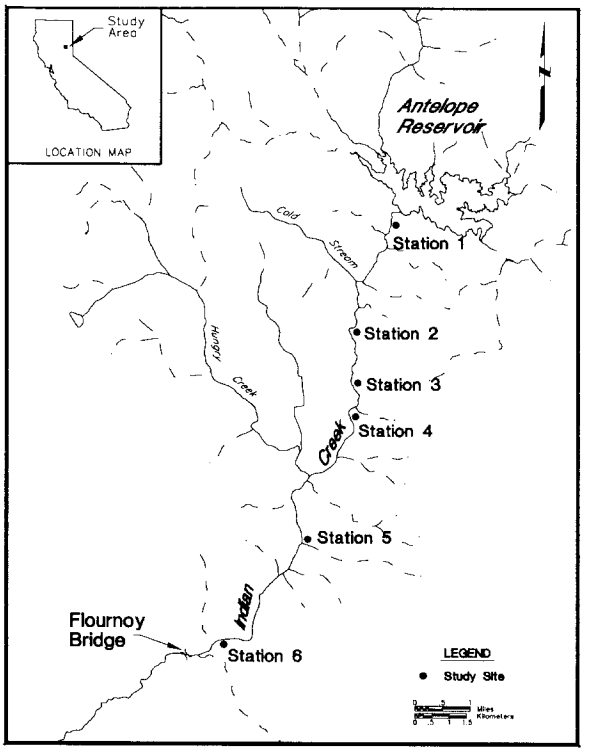

Figure 1 - Map of sampling stations in Indian Creek, Plumas County, 1999.

Stream flow is a combination of releases from Antelope Dam and inflow from tributaries such as Cold Stream and Hungry Creek. Storms and snowmelt can raise flows to flood levels in February, March, April, or May. Significant flooding occurred in 1982, 1983, and 1986. Summer flow is largely comprised of releases from the dam. Flow is 0.14 cms in very dry years, 0.28 cms in dry years, and 0.6 cms in normal or wet years (Hinton and Haines 1981).

Water quality and benthic organisms were sampled in six stations in 1979 in the study area by personnel from the Water Quality and Biology Unit of the Northern District of DWR. Dissolved oxygen averaged 9.8 ppm while pH averaged 7.3. Alkalinity was 44 mg\L as $CaCO_3$ while turbidity averaged 1.2 FTU. Dominant benthic macroinvertebrates were mayflies of the genus Baetis, stoneflies of the genus Hydropsyche, flies of the subfamily Chironominae, and flies of the genus Simulium (Boles 1980).

Species of fishes living in Indian Creek include: rainbow trout (Oncorhynchus mykiss), brown trout (Salmo trutta), golden shiners (Notemigonus crysoleucas),, Sacramento pike minnow (Ptychocheilus grandis), hardhead (Mylopharodon conocephalus), Lahontan redside (Richardsonius egregius), speckled dace (Rhinichthys osculus), Sacramento sucker (Catostomus occidentalis), brown bullhead (Amieurus nebulosus) and green sunfish (Lepomis cyanellus).

METHODS

Physical Measurements

Standing stocks of fishes were estimated at six stations in Indian Creek (Figure 1). Stations were intentionally selected to be near stations sampled in previous DFG studies (Gerstung 1973). Markers had previously been placed in trees along the stream to identify station boundaries. Stations varied in length from 39.9 to 69.8m. The length and width of each station was measured with metric tape measures.

Biological Measurements

Fish were captured with a battery-powered backpack electroshocker in stream sections blocked by seines as described by Platts et al. (1983) (Figure 2). Captured fish were removed from the net-enclosed section on each pass. Standing stock estimates were developed using the two-count method of Seber and LeCren (1967) or the multiple-pass method of Leslie and Davis (1939) with limits of confidence computed using a formula proposed by DeLury (1951).

The weights of trout and nongame fishes were measured by displacement (Figure 3). Fork length (FL) of each fish caught was measured to the nearest millimeter.

Figure 2. Electrofishing in Indian Creek, Plumas County.

Figure 3. Weighing trout by displacement.

Scale samples were taken from brown trout and rainbow trout over 100 mm in length. Scales were taken just above the lateral line between the dorsal and adipose fin (Scarrnecchia 1979) and placed in a piece of paper inserted in a small coin envelope (Drummond 1966). Scales were mounted dry between microscope slides, and their images were projected on a NCR microfiche reader at a magnification of 42x. Scale measurements for the calculation of growth were recorded to the nearest millimeter along the anterior radius of the anterior-posterior axis of the scale. Estimation of instantaneous population growth rate was calculated (Ricker 1975) with significant values of correlation coefficients taken from a table (Steel and Torrie 1960).

Instantaneous population growth rate = $b(\log_e l_2 - \log_e l_1)$

b = between ages functional slope

l_1 = initial length for the last complete year of growth

l_2 = final length for the last complete year of growth

Standing crops of brown trout and rainbow trout were calculated for individual stations where each species was caught and then combined for the entire creek. Age and growth was calculated for the population (Everhart et al. 1975). Length-weight relationships were determined for both brown trout and rainbow trout (Lagler 1956). The coefficient of condition and 95 percent confidence intervals were calculated for all trout (Carlander 1969).

RESULTS

Distribution

Brown trout were caught at stations 1 through 5. Rainbow trout were caught at stations 2 and 6 Sacramento suckers, Sacramento pike minnows, and green sunfish were also caught in station 6 (Table 1).

Table 1. Distribution of fishes in sections of Indian Creek, Plumas County, 1999.

Species	Station Number					
	1	2	3	4	5	6
Brown trout	X	X	X	X	X	
Rainbow trout		X			X	X
Sacramento pike minnow						X
Sacramento sucker						X
Green sunfish						X

Standing Crop

Brown trout were the most common game fish caught in Indian Creek. Biomass averaged 3.8 g/m^2 at five stations. Biomass for brown trout large enough for anglers to catch and keep (127 mm FL and larger) averaged 2.9 g/m^2 (Table 2). Rainbow trout biomass averaged 1.5 g/m^2, while the biomass for catchable trout averaged 1.4 g/m^2 (Table 3).

Table 2. Estimates of brown trout standing crop in Indian Creek, Plumas County, 1999.

Distance below Antelope Dam (km)	Population Estimate	95 Percent Confidence Estimate	Biomass (g/m^2)	Estimate of Catchable Trout	Biomass of Catchable Trout (g/m^2)
1.3	4	4-4	1.7	3	1.7
3.9	50	48-55	9.8	47	7.7
5.3	40	29-66	3.1	11	1.9
6.6	31	29-37	2.2	11	1.7
12.3	33	28-45	2.4	8	1.3

Table 3. Estimates of rainbow trout standing crop in Indian Creek, Plumas County, 1999.

Distance below Antelope Dam (km)	Population Estimate	95 Percent Confidence Estimate	Biomass (g/m^2)	Estimate of Catchable Trout	Biomass of Catchable Trout (g/m^2)
3.9	4	4-4	0.6	4	0.6
12.3	21	21-22	1.3	11	1.1
21.0	13	13-14	2.6	7	2.5

Age and Growth

The formula FL = -4.9 + 3.0 S describes the relationship between the fork length and enlarged scale radius (S) of 139 brown trout caught in Indian Creek. The coefficient of correlation (r^2) is 0.97. The formula was FL = -5.2 + 3.1 S for 38 rainbow trout caught, while the value for r^2 is 0.99.

Both the population instantaneous growth rate and the mean individual instantaneous growth rate were the same in age 1+ brown trout (Table 4). Population growth was faster than mean individual growth in age 1+ rainbow trout (Table 5).

Table 4. Growth rates for brown trout caught in Indian Creek, Plumas County, 1999.

Age Interval	Population Growth			Mean Individual Growth		
	Length Interval (mm)	Difference of Natural Logarithms	Instantaneous Growth Rate G_x	Length Interval (mm)	Difference of Natural Logarithms	Instantaneous Growth Rate G_x
1-2	96-190	0.683	2.048	96-190	0.683	2.048

Table 5. Growth rates for rainbow trout caught in Indian Creek, Plumas County, 1999.

Age interval	Population Growth			Mean Individual Growth		
	Length Interval (mm)	Difference of Natural Logarithms	Instantaneous Growth Rate G_x	Length Interval (mm)	Difference of Natural Logarithms	Instantaneous Growth Rate G_x
1-2	78-158	0.706	2.118	86-158	0.608	1.825

Age 1+ brown trout averaged 167 mm in fork length; 2+ fish averaged 241 mm (Table 6). Age 1+ and 2+ rainbow trout measured 139 mm and 226 mm, respectively (Table 7).

Table 6. Calculated fork length of brown trout from Indian Creek, Plumas County, 1999.

Age	Number of Fish	Length at Capture (mm)	Calculated Lengths at Successive Annuli	
			1	2
1	84	167	96	
2	10	241	96	190
Number of back-calculations			94	10
Weighted means (mm)			96	190
Increments (mm)			96	94

Table 7. Calculated fork length of rainbow trout from Indian Creek, Plumas County, 1999.

Age	Number of Fish	Length at Capture (mm)	Calculated Lengths at Successive Annuli	
			1	2
1	16	139	78	
2	2	226	86	158
Number of back-calculations			18	2
Weighted means (mm)			79	158
Increments (mm)			79	79

Length and Weight

Age group 0+ brown trout represented 8 percent of the catch. Ages 1+ and 2+ fish represented 63 percent and 24 percent, respectively, while 3+ fish made up 5 percent (Figure 4). Age group 0+ rainbow trout represented 18 percent of the catch. Ages 1+ and 2+ trout made up 67 percent and 12 percent, respectively, while 3+ fish made up 3 percent (Figure 5).

The relationship between length (L) and weight (W) of brown trout is:

$$\text{Log}_{10} W = -4.8 + 2.9 \text{Log}_{10} L$$
$$r^2 = 0.99$$
N = 139 (Figure 6 and Appendix 2)

The same relationship for rainbow trout is:

$$\text{Log}_{10} W = -5.2 + 3.1 \text{Log}_{10} L$$
$$r^2 = 0.99$$
N = 38 (Figure 7 and Appendix 3)

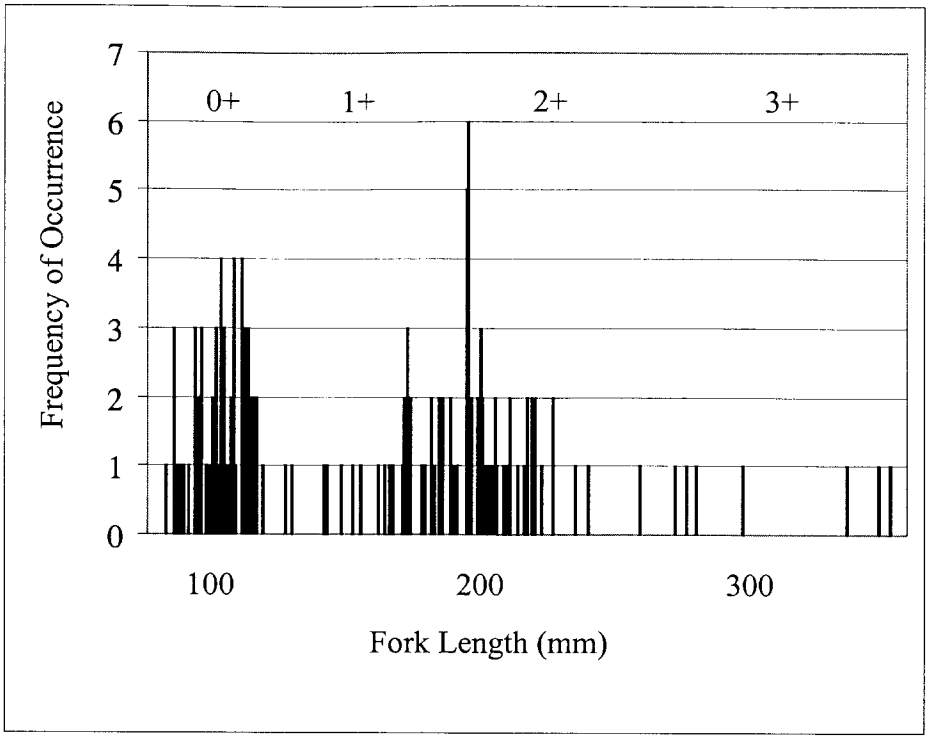

Figure 4. Length, observed frequency, and age of brown trout caught in Indian Creek, Plumas County, 1999.

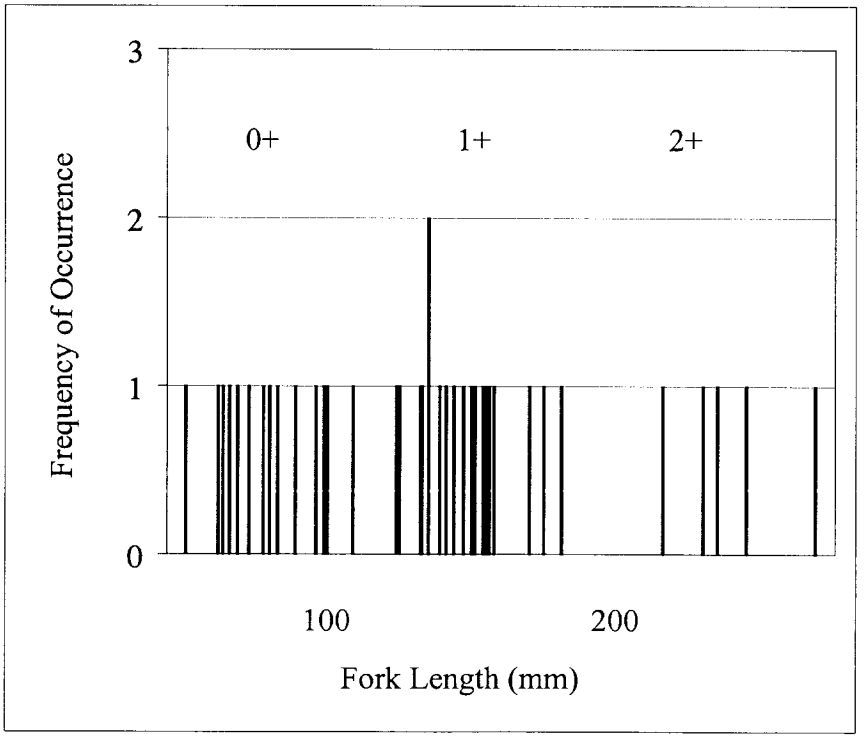

Figure 5. Length, observed frequency and age of rainbow trout caught in Indian Creek, Plumas County, 1999.

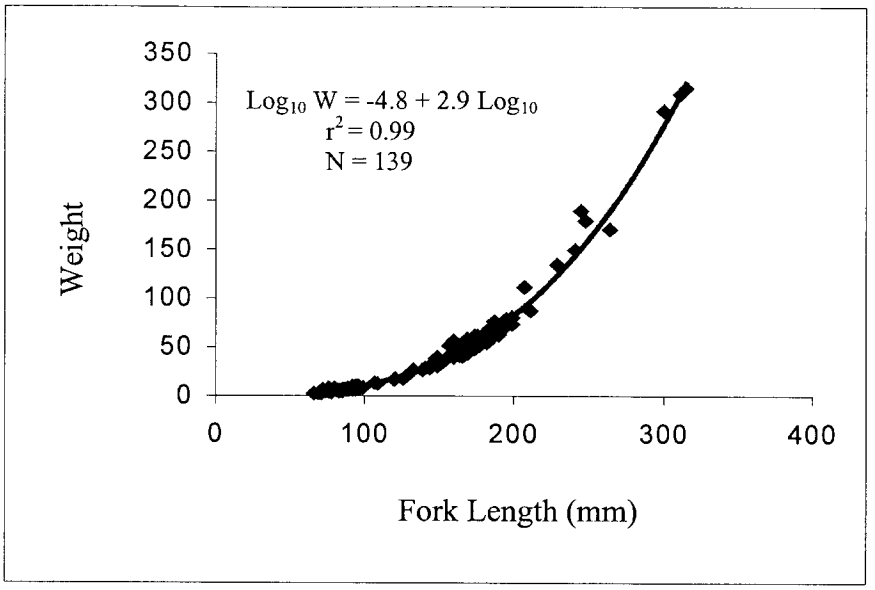

Figure 6. The relationship between length and weight of brown trout caught in Indian Creek, Plumas County, 1999.

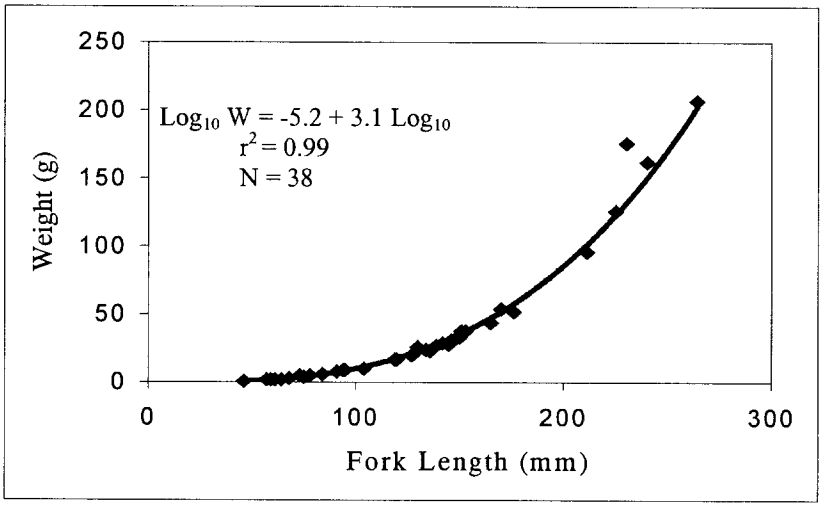

Figure 7. The relationship between length and weight of rainbow trout caught in Indian Creek, Plumas County, 1999.

Coefficient of Condition

We calculated the coefficient of condition and 95 percent confidence limits for a total of 139 brown trout and 38 rainbow trout (Table 8).

Table 8. Condition of brown trout and rainbow trout in Indian Creek, Plumas County, 1999.

Age	Number of Fish	Coefficient of Condition	95% Confidence Interval
Brown trout			
0+	58	1.0772	0.6946-1.4598
1+	71	1.0371	0.8486-1.2256
2+	7	1.1138	0.8513-1.3763
3+	3	1.0388	0.9777-1.0999
Combined	139	1.0577	0.7653-1.3501
Rainbow trout			
0+	14	1.0045	0.7745-1.2344
1+	19	1.0139	0.8859-1.1418
2+	5	1.1743	0.8911-1.4575
Combined	38	1.0315	0.8075-1.2555

DISCUSSION

Biomass of rainbow trout was below average values for previous years, but the population estimate was average. Biomass and population estimates for brown trout were both below average (Table 9). Brown trout populations have not fully recovered from low streamflow that was a result of drought conditions in the early 1990s. Low summer flows reduced available rearing habitat and limited production. Summer flow and trout habitat are related in Indian Creek (Hinton and Haines 1981).

Table 9. Population estimates and biomass of rainbow and brown trout in Indian Creek, 1977-1999.

Date	Rainbow Trout		Brown Trout	
	Biomass (g/m^2)	Population Estimate (no/m^2)	Biomass (g/m^2)	Population Estimate (no/m^2)
1977	0.7	0.01	5.7	0.16
1978	0.4	0.01	5.0	0.07
1979	1.2	0.02	4.9	0.42
1980	2.7	0.07	5.8	0.16
1981	0.7	0.01	5.0	0.19
1982	0.4	0.05	4.4	0.09
1986	0.9	0.04	2.8	0.03
1987	2.1	0.01	4.6	0.18
1988	0.3	0.01	5.6	0.67
1989	0.6	0.01	5.7	0.12
1990	2.2	0.02	4.2	0.17
1993	0.5	0.01	4.0	0.07
1995	0.4	0.01	3.9	0.07
1999	1.5	0.02	3.8	0.07
Mean	1.0	0.02	4.7	0.18

The relationship between summer flow and brown trout populations is highly significant ($p < 0.01$), while the relationship between flow and population of all trout is also significant ($p < 0.05$). Catchable-sized trout greatly benefit from higher summer flows. The correlation between flow and catchable brown and rainbow trout are significant ($p < 0.01$) (Brown 1993).

High flows in 1997 washed out the flow gauge on Indian Creek. We do not have data on the flows in the winter of 1998-99. The spill from Antelope Lake began in late April 1999. The spill lasted until early July 1999 and was mild, not exceeding 6.2 cms. These relatively low spring flows were not likely to displace young trout. However, Indian Creek was subjected to high flow during spring of 1995. Few age 0 brown or

rainbow trout remained in the study area. The abundance of young brown and rainbow trout in Indian Creek is significantly ($P<0.05$) correlated with spring floods (Brown 1993). Spring floods devastated age 0 trout in Indian Creek in 1982, 1986, and 1993 based on population sampling the following September. High flows in spring destroyed redds, killing eggs, and washing newly emerged trout out of the study area. Spring floods can decimate eggs and young of fall spawning trout (Seegrist and Gard 1972, Hansen and Waters 1974, Harvey 1987). Young-of-the-year brown trout are more strongly affected by floods than adults because of their limited swimming ability and small size. Young-of- the-year rainbow trout are also negatively affected by spring floods (Pearsons et al. 1992). Floods can result in the loss of multiple year classes of rainbow and brown trout due to destruction of eggs and fry and mortality of older trout due to loss of habitat (Hansen and Waters 1974).

Rates of instantaneous population growth were slightly below average for brown and above average for rainbow trout in 1999 (Table 10). Growth was high because trout were exposed to favorable rearing habitat in 1999 as summer flow was 0.57 cms. Growth in Indian Creek could be related to flow because increased flows increase useable habitat for the two elements of food production and cover (Hinton and Haines 1981). These two elements influence productivity, standing crops, and growth (Saunders and Smith 1963, Lewis 1969, Mesick 1968, Wesche et al. 1987, Jowett 1992).

Table 10. Estimates of instantaneous population growth rate (g) of brown trout and rainbow trout in Indian Creek, 1999.

Year	Brown Trout		Rainbow Trout	
	Age Interval			
	I-II	II-III	I-II	II-III
1978	2.214	0.938		
1979	1.394	1.670		
1980	2.086	1.219		
1981	1.850	1.505		
1982	2.029	-	1.541	
1986	1.777	0.965	1.242	1.151
1987	1.974	1.012	2.080	1.070
1988	2.616	0.605	1.329	
1989	2.288	-	1.856	
1990	2.154	1.776	2.378	
1993	2.535	0.981	1.943	
1995	2.445	1.216	2.144	
1999	2.048		2.118	
Mean	2.108	1.189	1.848	1.111

LITERATURE CITED

Boles, G. 1980. Indian Creek survey. Calif. Dept. of Water Resources. 11 p.

Brown, C. 1978. Standing stocks of fishes in sections of Indian Creek, Plumas County, 1977. Calif. Dept. of Fish and Game, 23 p.

_____. 1991a. Standing stocks of fishes in sections of Indian Creek, Plumas County, 1989. Calif. Dept. of Fish and Game, 19 p.

_____.1991b. Standing stocks of fishes in sections of Indian Creek, Plumas County, 1990. Calif. Dept. of Fish and Game, 20 p.

_____1993. A summary of studies of fish populations in Indian Creek, Plumas County, 1977-1990. Calif. Dept. of Fish and Game, 30 p.

_____.1996. Standing stocks of fishes in sections of Indian Creek, Plumas County, 1995. Calif. Dept. of Fish and Game, 20 p.

_____ and S. Haines. 1979. Standing stocks of fishes in sections of Indian Creek, Plumas County, 1978. Calif. Dept. of Fish and Game, 14 p.

Bumpass, D.K., and C.J. Brown. 1989. Standing stocks of fishes in sections of Indian Creek, Plumas County, 1988. Calif. Dept. of Fish and Game, 14 p.

_____ and K. Smith, 1989. Standing stocks of fishes in sections of Indian Creek, Plumas County, 1987. Calif. Dept. of Fish and Game, 14 p.

_____, K. Smith, and C. Brown. 1987a. Standing stocks of fishes in sections of Indian Creek, Plumas County, 1982. Calif. Dept. of Fish and Game, 14 p.

_____.1987b. Standing stocks of fishes in sections of Indian Creek, Plumas County, 1986. Calif. Dept. of Fish and Game, 14 p.

Carlander, K.D. 1969. Handbook of Freshwater Fishery Biology, Vol. 1. Ames, Iowa: The Iowa State University Press. 752 p.

DeLury, D.B. 1951. On the planning of experiments for the estimation of fish populations. J. Fish. Res. Bd. Canada. 8:281-307.

Department of Water Resources. 1979. Preliminary study of instream enhancement opportunities. Calif. Dept. of Water Resources, 113 p.

Drummond, R.A. 1966. Techniques in the collection and mounting of trout scales. Progressive Fish Culturist 28(2): 113-116.

Everhart, H.W., A.W. Eipper, and W.D. Youngs. Principles of Fishery Science. Ithaca, N.Y.:Cornell University Press. 288 p.

Gerstung, E.R. 1973. Fish populations and yield estimates from California streams. Cal-Neva Wildlife 9-19.

Haines, S., and C. Brown. 1980. Standing stocks of fishes in sections of Indian Creek, Plumas County, 1979. Calif. Dept. of Fish and Game, 14 p.

Hansen, D.L. and T.F. Waters. 1974. Recovery of standing crop and production rate of a brook trout population in a flood damaged stream. Trans. Amer. Fish. Soc. 103(3): 431-439.

Harvey, B.C. 1987. Susceptibility of young-of-the-year fishes to downstream displacement by flooding. Trans. Amer. Fish. Soc. 116(6):851-855.

Hinton, R.N. 1983. Recreation use survey of Indian Creek, Plumas County, 1982. Calif. Dept. Water Resources, Technical Information Report No. 83-1. 18 p.

_____.and S.L. Haines. 1981. Evaluation of a revised operation for Antelope Reservoir. Calif. Dept. Water Resources, Northern District Report. 58 p.

Jowett, I.G. 1992. Models of the abundance of large brown trout in New Zealand rivers. North American Journal of Fisheries Management 12(3): 417-432.

Lagler, K.F. 1956. Freshwater Fishery Biology. Dubuque, Iowa: Wm. C. Brown. 421 p.

Leslie, P.H., and D.H.S. Davis. 1939. An attempt to determine the absolute number of rats in a given area. J. Animal Ecology 8:94-113.

Lewis, S.L. 1969. Physical factors influencing fish populations in pools of a trout stream. Trans. Amer. Fish. Soc. 98(1): 14-19.

Mesick, C.F. Effects of food and cover on numbers of Apache and brown trout establishing residency in artificial stream channels. Trans. Amer. Fish. Soc. 117(5): 421-431.

Pearsons, T.N., H.W. Li, and G.A. Lamberti. 1992. Influence of habitat complexity on resistance to flooding and resilience of stream fish assembledges. Trans. Amer. Fish. Soc.121(4): 427-436.

Platts, W.S., W.F. Megahan, and G.W. Minshall. 1983. Methods for evaluating stream, riparian, and biotic conditions. Gen. Tech. Rep. INT-138. Ogden, UT:U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experimental Station; 1983. 70p.

Ricker, W. E. 1975. Computation and interpretation of biological statistics of fish populations. Fish. Res. Bd. Canada. Bull. 191.

Saunders, J.W. and M.W. Smith. 1962. Physical alteration of stream habitat to improve brook trout production. Trans. Amer. Fish. Soc. 91(2): 185-188.

Scarnecchia, D.L. 1979. Variation of scale characteristics of coho salmon with sampling location on the body. Progressive Fish Culturist 41(3): 132-135.

Seber, G. A. F., and E. D. LeCren. 1967. Estimating population parameters from catches large relative to the population. J. Animal Ecology. 36(3):631-643.

Seegrist D.W. and R. Gard. 1972. Effects of floods on trout in Sagehen Creek, California. Trans. Amer. Fish. Soc. 103(3): 478-482.

Steel, R.G.D. and J.H. Torrie. 1960. Principles and Procedures of Statistics. McGraw-Hill Book Company, Inc. 481 p.

Villa, N. 1982. Standing stocks of fishes in sections of Indian Creek, Plumas County, 1981. Calif. Dept. of Fish and Game. 23 p.

_____ and C.J. Brown. 1981. Standing stocks of fishes in sections of Indian Creek, Plumas County, 1980. Calif. Dept. of Fish and Game. 23 p.

Wesche, T.A., C.M. Goertler, and W.A. Hubert. 1987. Modified habitat suitability index model for brown trout in southwestern Wyoming. North American Journal of Fisheries Management 7(2): 232-237.

APPENDIX 1

FISH POPULATION STATIONS ON INDIAN CREEK,
PLUMAS COUNTY, SEPTEMBER 1999 AT 0.56 CMS

Station	Distance below Antelope Dam (km)	UTM	Surface Length (m)	Area (m^2)
1	1.3	035 439	53.6	300.2
2	3.9	025 467	54.3	412.7
3	5.3	024 453	69.8	425.8
4	6.6	010 423	67.7	358.8
5	12.3	009 409	39.9	351.1
6	21.0	982 377	42.4	375.6

APPENDIX 2

LENGTH AND WEIGHT OF BROWN TROUT CAUGHT IN INDIAN CREEK, SEPTEMBER 1999

LENGTH	WEIGHT	LENGTH	WEIGHT	LENGTH	WEIGHT	LENGTH	WEIGHT
66	3	89	7	149	31	176	62
69	3	89	8	150	35	177	52
69	3	90	7	150	32	178	61
69	3	92	8	154	37	179	59
70	4	92	7	155	39	179	62
71	3	92	10	157	52	180	60
72	7	92	8	157	42	182	55
74	5	93	8	158	42	183	59
76	5	93	9	160	57	184	58
76	5	93	8	160	40	184	70
76	8	94	10	161	42	187	77
77	6	94	7	161	44	189	70
77	5	94	9	164	42	190	72
78	4	95	10	164	46	190	63
78	4	95	8	165	50	192	68
78	5	96	10	166	41	192	74
80	8	96	10	169	47	193	74
81	6	97	9	169	59	193	77
82	6	97	8	169	44	195	79
82	6	99	9	169	47	199	81
83	6	107	14	169	54	199	74
83	5	109	13	170	46	207	112
83	6	120	17	170	54	211	88
84	6	121	18	170	46	229	135
85	5	126	18	170	51	241	150
85	7	130	23	170	48	245	190
85	6	133	27	170	51	248	180
85	7	139	27	171	52	264	171
86	7	141	29	171	50	300	292
86	7	143	30	173	57	311	309
86	7	144	29	173	51	315	315
87	7	147	34	174	50		
88	7	148	36	174	49		
88	7	148	39	174	62		
89	7	149	40	175	53		
89	8	149	31	175	60		

APPENDIX 3

LENGTH AND WEIGHT OF RAINBOW TROUT CAUGHT IN INDIAN CREEK, SEPTEMBER 1999

LENGTH	WEIGHT	LENGTH	WEIGHT
46	1	130	26
57	2	134	24
59	2	136	23
61	2	139	27
64	2	142	29
68	3	145	28
73	5	146	31
75	4	149	33
78	5	150	33
84	6	151	38
91	8	153	38
94	9	165	44
95	9	170	54
104	10	176	52
119	17	211	96
120	17	225	126
127	20	230	176
128	21	240	162
130	24	264	207